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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/509,662	08/22/2005	Takuya Sugawara	101249.55470US	2368
23911 7590 09/26/2008 CROWELL & MORING LLP INTELLECTUAL PROPERTY GROUP P.O. BOX 14300 WASHINGTON, DC 20044-4300			EXAMINER LEE, CHEUNG	
			ART UNIT 2812	PAPER NUMBER
			MAIL DATE 09/26/2008	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/509,662	Applicant(s) SUGAWARA ET AL.	
	Examiner CHEUNG LEE	Art Unit 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20,22,24,25,27-29 and 31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20,22,24,25,27-29 and 31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>6-11-08</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to Applicant

1. Applicants' Amendment and Response to the Office Action mailed on February 4, 2008 has been entered and made of record.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on June 11, 2008 was filed before the first action on the merits. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is considered by the examiner.

Response to Amendment

3. In view of applicants' amendments and arguments filed on June 24 2008, the rejections of claims 20-33 under 35 U.S.C. 103(a) as stated in the indicated Office Action have been withdrawn. Applicants' arguments have been rendered moot in view of the new or modified ground of rejection given below.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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4. Claims 25 and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Hattangady et al. (NPL: "Controlled nitrogen incorporation at the gate oxide surface," June 1995; hereinafter "Hattangady").

5. Hattangady discloses [Re claim 25] a process for treating a substrate (col. 2 on page 3495) by plasma nitridation (see abstract), comprising: forming an oxide film on the substrate (col. 2 on page 3495); and irradiating plasma on the oxide film using a mixed gas comprising a rare gas and nitrogen gas (He-N₂ plasma nitridation; col. 2 on page 3495; see abstract) to form an oxynitride film (col. 2 on page 3496), wherein the plasma is irradiated on the oxide film at a temperature of 250 to 500°C and under a pressure of 7 to 260 Pa (plasma nitridation at 300°C and 0.1 Torr (~13.3 Pa); col. 2, page 3495), a nitrogen atom content in the oxynitride film has a distribution such that the maximum value N_s of the nitrogen atom content in the oxynitride film at a surface of the oxynitride film opposite a surface facing the substrate is 10 to 40 atomic percent (~22 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the maximum value N_b of the nitrogen atom content in the oxynitride film at the surface facing the substrate side is 0 to 10 atomic percent (between 0-8 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the ratio N_s/N_b is 2 or more (see fig. 3).

6. Hattangady discloses [Re claim 28] wherein the ratio N_s/N_b is 4 or more (as shown in figure 3, the N_s value is about 22 and N_b value is from 0 to 8. Therefore, if N_b is somewhere between 0 and 5, the claimed limitation is met).

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 20, 22, 24 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hattangady in view of Murakawa et al. (JP2000-294550; hereinafter "Murakawa").

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8. Hattangady discloses [Re claim 20] a process for treating a substrate (col. 2 on page 3495) by plasma nitridation (see abstract), comprising: providing the substrate having an oxide film thereon (col. 2 on page 3495); and irradiating plasma on the oxide film using a mixed gas comprising a rare gas and nitrogen gas (He-N₂ plasma nitridation; col. 2 on page 3495; see abstract) to form an oxynitride film (col. 2 on page 3496), wherein the plasma is irradiated on the oxide film at a temperature of 250 to 500°C and under a pressure of 7 to 260 Pa (plasma nitridation at 300oC and 0.1 Torr (~13.3 Pa); col. 2, page 3495), a nitrogen atom content in the oxynitride film has a distribution such that the maximum value Ns of the nitrogen atom content in the oxynitride film at a surface of the oxynitride film opposite a surface facing the substrate is 10 to 40 atomic percent (~22 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the maximum value Nb of the nitrogen atom content in the oxynitride film at the surface facing the substrate side is 0 to 10 atomic percent (between 0-8 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the ratio Ns/Nb is 2 or more (see fig. 3).

However, Hattangady fails to disclose expressly wherein irradiating plasma having an electron temperature of 0.5 to 2.0 eV.

Murakawa discloses wherein a nitriding process using an electron temperature of about 1 eV or less (paragraph 10).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use a certain electron temperature in a plasma nitridation, as taught by Murakawa, because it would have been to reduce a plasma damage using a certain electron temperature.

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9. [Re claims 22 and 27] Hattangady fails to disclose expressly wherein the plasma is generated using microwave irradiation by using a plane antenna member having a plurality of slots.

Murakawa discloses wherein plasma is generated using microwave irradiation with a RLSA (radial line slot antenna) which has two or more slits (paragraph 24).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use certain plasma equipment with microwave, as taught by Murakawa, because it would have been to obtain plasma with microwave radiation of a uniform intensity performing film-quality control.

10. Hattangady discloses [Re claim 24] wherein the oxide film is formed by plasma processing or thermal oxidation (col. 2, on page 3495).

11. Claims 29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hattangady in view of Kraft et al. (US Pat. 6136654; hereinafter "Kraft") and Murakawa.

12. Hattangady discloses [Re claim 29] a process for forming a gate oxynitride film (col. 2 on page 3496), comprising: providing a substrate having an oxide film thereon (col. 2 on page 3495); and irradiating plasma on the oxide film using a mixed gas comprising a rare gas and nitrogen gas (He-N₂ plasma nitridation; col. 2 on page 3495; see abstract) to form the oxynitride film (col. 2 on page 3496), wherein the plasma is irradiated on the oxide film at a temperature of 250 to 500°C and under a pressure of 7 to 260 Pa (plasma nitridation at 300°C and 0.1 Torr (~13.3 Pa); col. 2, page 3495), a

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nitrogen atom content in the oxynitride film has a distribution such that the maximum value N_s of the nitrogen atom content in the oxynitride film at a surface of the oxynitride film opposite a surface facing the substrate is 10 to 40 atomic percent (~22 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the maximum value N_b of the nitrogen atom content in the oxynitride film at the surface facing the substrate side is 0 to 10 atomic percent (between 0-8 nitrogen at. %; col. 2 on page 3496; see figs. 3 and 5), and the ratio N_s/N_b is 2 or more (see fig. 3).

However, Hattangady fails to disclose expressly wherein irradiating plasma having density of 1×10^{10} to $5 \times 10^{12}/\text{cm}^3$ and an electron temperature of 0.5 to 2.0 eV.

Kraft discloses wherein a plasma density is between 1×10^{10} and $1 \times 10^{12} \text{ cm}^{-3}$ for a plasma nitridation (col. 4, lines 1-11).

Murakawa discloses wherein a nitriding process using an electron temperature of about 1 eV or less (paragraph 10).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use a certain plasma density and a certain electron temperature in a plasma nitridation, as taught by Kraft and Murakawa, because it would have been to obtain an optimum nitridation while reducing a plasma damage using a certain plasma parameters.

13. [Re claim 31] Hattangady fails to disclose expressly wherein the plasma is generated using microwave irradiation by using a plane antenna member having a plurality of slots.

Murakawa discloses wherein plasma is generated using microwave irradiation with a RLSA (radial line slot antenna) which has two or more slits (paragraph 24).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use certain plasma equipment with microwave, as taught by Murakawa, because it would have been to obtain plasma with microwave radiation of a uniform intensity performing film-quality control.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHEUNG LEE whose telephone number is 571-272-

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5977. The examiner can normally be reached on Monday through Friday from 9:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Garber can be reached on 571-272-2194. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Walter L. Lindsay, Jr./
Primary Examiner, Art Unit 2812

/Cheung Lee/
Examiner, Art Unit 2812
September 16, 2008